

**Remarks**

Claims 1, 2, 8, 13, 14, 20, 21 and 25-32 are pending herein. By this Amendment, claims 3-7, 10-12, 15-19 and 22-24 have been canceled; claims 1, 2, 8, 9, 13, 14, 20 and 21 have been amended; and new claims 25-32 have been added.

Claims 1 and 13 have been amended in part to recite that the substrate is disposed in a processing vessel. Support for this feature can be found in the specification at, e.g., page 9, lines 22-25.

Claims 1 and 13 also have been amended in part to recite that the rare gas atmosphere is formed in the processing vessel. Support for this recitation can be found in the specification at, e.g., page 9, lines 30-35.

Claims 1 and 13 have also been amended to recite two sub-steps for the modifying step. The first sub-step involves curing the organic film by irradiating the organic film with the electron beams in the rare gas atmosphere of a first pressure in the processing vessel. The second sub-step involves imparting the affinity for the polar liquid (claim 1) or the inorganic film (claim 13) by irradiating the organic film with the electron beams in the rare gas atmosphere of a second pressure higher than the first pressure in the processing vessel. Support for these amendments to claims 1 and 13 can be found, e.g., in canceled claims 4, 5, 16 and 17.

Claims 2 and 14 have been amended to recite that the first pressure is below 1 torr and the second pressure is 1 torr or above. Support for these recitations can be found in the specification at, e.g., page 11, lines 28-33.

Claims 8 and 20 have been amended to recite that a first voltage is applied to the electron-beam irradiation device at the sub-step of curing the organic film and a second voltage lower than the first voltage is applied to the electron-beam irradiation device at the sub-step of imparting the affinity. Support for these recitations can be found in the specification at, e.g., page 12, lines 1-10.

Claims 9 and 21 have been amended to recite that the first voltage is above 20 kV and the second voltage is 20 kV or below. Support for these recitations can be found in the specification at, e.g., lines 4-10.

New claims 25 and 29 depend upon claims 1 and 13, respectively, and recite that the sub-step of imparting the affinity is carried out with the second pressure of 2-10 torr while heating

the substrate at 200°C to 400°C. Support for new claims 25 and 29 can be found in the specification at, e.g., page 10, line 33 – page 11, line 1.

New claim 26 is an independent claim combining the features of claims 1 and 8 and also including a step of further curing a surface of the organic film by irradiating the organic film with the electron beams with a second voltage lower than the first voltage applied to the electron-beam irradiation device, in the rare gas atmosphere of the first pressure in the processing vessel. New claim 30 is an independent claim combining the features of claims 13 and 20 and also including the step of further curing a surface of the organic film by irradiating the organic film with the electron beams with a second voltage lower than the first voltage applied to the electron-beam irradiation device, in the rare gas atmosphere of the first pressure in the processing vessel. Support for new claims 26 and 30 can be found in canceled claims 10 and 22, and in the specification at, e.g., Example 9 (pages 21-22).

New claims 26 and 30 also recite that the organic film is cured entirely. Support for this language can be found in the specification at, e.g., page 7, line 16, and page 12, line 24.

New claims 27 and 31 depend upon claims 26 and 30, respectively, and recite that the first pressure is below 1 torr and the second pressure is 1 torr or above. Support for these recitations can be found in the specification at, e.g., page 11, lines 28-33.

New claims 28 and 32 depend upon claims 26 and 30, respectively, and recite that the first voltage is above 20 kV and the second voltage is 20 kV or below. Support for these recitations can be found in the specification at, e.g., lines 4-10.

In the Office Action, claims 13, 15, 19-21, 23 and 24 are rejected under 35 U.S.C. §102(b) as being anticipated by U.S. Published Application No. 2001/0000415A1 to Ross (“Ross”); claims 14, 16-18 and 22 are rejected under 35 U.S.C. §103(a) as being unpatentable over Ross; and claims 1-12 are rejected under 35 U.S.C. §103(a) as being unpatentable over U.S. Published Application No. 2002/0123240A1 to Gallagher et al. (“Gallagher”) in view of Ross and U.S. Patent No. 6,420,088 to Angelopoulos et al. (“Angelopoulos”).

In view of the amendments and remarks herein, Applicants respectfully request reconsideration and withdrawal of the rejections set forth in the Office Action.

**I. Rejection of Claims 13, 15, 19-21, 23 and 24**

Claims 13, 15, 19-21, 23 and 24 are rejected under §102(b) as being anticipated by Ross.

Applicants respectfully submit that claims 13, 20, and 21 and new claim 29 (which depends upon claim 13) would not have been anticipated by Ross. Claims 15, 19, 23 and 24 have been canceled.

As discussed previously, claim 13 has been amended to recite two sub-steps for the modifying step. The first sub-step involves curing the organic film by irradiating the organic film with the electron beams in the rare gas atmosphere of a *first pressure* in the processing vessel. The second sub-step involves imparting the affinity for the inorganic film by irradiating the organic film with the electron beams in the rare gas atmosphere of a *second pressure higher than the first pressure* in the processing vessel.

Ross does not teach or suggest changing the pressure of the rare gas atmosphere during a modifying step. In particular, Ross does not teach or suggest dividing a modifying step so that a first pressure is used in a first sub-step and a second pressure higher than the first pressure is used in a second sub-step.

Thus, for at least this reason, Applicants respectfully submit that claims 13, 20, 21 and 29 would not have been anticipated by Ross.

**II. Rejection of Claims 14, 16-18 and 22**

Claims 14, 16-18 and 22 are rejected under §103(a) as being unpatentable over Ross.

Claims 16-18 and 22 have been canceled. Applicants respectfully submit that claim 14 would not have been obvious over Ross.

Claim 14 depends upon claim 13, and has been amended herein to recite that the first pressure is below 1 torr and the second pressure is 1 torr or above.

Although acknowledging that Ross does not teach that the modifying step therein changes the pressure, the Office Action refers to the pressure used in Applicants' claimed invention as a result effective variable. The Examiner states that it would have been obvious to modify the conditions to be within the claimed range in order to remove the moisture and particles on the surface and to prepare it for subsequent layers especially absent any criticality in using the conditions in the claimed range.

Applicants respectfully submit that the pressures used in the methods of instant claims 13 and 14 are not result effective variables.

The instant specification teaches that:

The EB curing process can be divided into a first stage for curing the SOD film and a second stage of making the SOD film hydrophilic by *changing the pressure* of the rare gas atmosphere during the EB curing process *to ensure that the SOD film is cured and made hydrophilic satisfactorily*. For example, the rare gas atmosphere is kept at a *pressure not higher than 1 torr* and the SOD film is irradiated with electron beams to cure the SOD film in an initial stage of the EB curing process, and then the rare gas atmosphere is *increased to a pressure higher than 1 torr* to promote the generation of radicals by ionizing the rare gas. Consequently, the radicals act on the surface of the SOD film to make the surface of the SOD film hydrophilic by cutting chemical bonds of hydrophobic groups, such as alkyl groups.

Thus, changing the pressure of the rare gas atmosphere during the modifying step as Applicants describe in claims 13 and 14 ensures that the SOD film is cured and made hydrophilic satisfactorily.

Thus, for at least this reason, Applicants submit that the use of first and second pressures as recited in instant claim 14, wherein the second pressure is higher than the first pressure, are not result effective variables, and that claim 14 would not have been obvious over Ross.

### **III. Rejection of Claims 1-12**

Claims 1-12 are rejected under §103(a) as being unpatentable over Gallagher in view of Ross and Angelopoulos.

Claims 3-7 and 10-12 have been canceled. Applicants respectfully submit that claims 1, 2, 8, and 9 would not have been obvious over Gallagher in view of Ross and Angelopoulos.

Claim 1 has been amended to recite two sub-steps for the modifying step. The first sub-step involves curing the organic film by irradiating the organic film with the electron beams in the rare gas atmosphere of a *first pressure* in the processing vessel. The second sub-step involves imparting the affinity for the polar liquid by irradiating the organic film with the electron beams in the rare gas atmosphere of a *second pressure higher than the first pressure* in the processing vessel.

None of the references cited in the Office Action teaches or suggests changing the pressure of the rare gas atmosphere during a modifying step such that a first pressure is used in a first sub-step and a second pressure higher than the first pressure is used in a second sub-step.

As discussed above, the use in such sub-steps of a first pressure and a second pressure higher than the first pressure does not constitute a result effective variable.

Thus, for at least this reason, Applicants respectfully submit that claims 1, 2, 8, and 9 would not have been obvious over Gallagher in view of Ross and Angelopoulos.

#### **IV. New Claims 26-28 and 30-32**

Applicants further respectfully submit that claims 26-28 and 30-32 are patentable over the references cited in the Office Action. New claim 29, which depends upon claim 13, was discussed previously in connection with the rejection of claim 13.

As pointed out earlier, new claim 26 is an independent claim combining the features of claims 1 and 8 and also including a step of further curing a surface of the organic film by irradiating the organic film with the electron beams with a second voltage lower than the first voltage applied to the electron-beam irradiation device, in the rare gas atmosphere of the first pressure in the processing vessel. New claim 30 is an independent claim combining the features of claims 13 and 20 and also including the step of further curing a surface of the organic film by irradiating the organic film with the electron beams with a second voltage lower than the first voltage applied to the electron-beam irradiation device, in the rare gas atmosphere of the first pressure in the processing vessel.

None of the references cited in the Office Action teaches or suggests the methods recited in claims 26 and 30. Specifically, none of the references teaches or suggests dividing a modifying step into the following three sub-steps:

- (1) curing the organic film by irradiating the organic film with the electron beams with a *first voltage* applied to the electron-beam irradiation device, in the rare gas atmosphere of a *first pressure* in the processing vessel;
- (2) further curing a surface of the organic film by irradiating the organic film with the electron beams with a *second voltage* lower than the *first voltage* applied to the electron-beam irradiation device, in the rare gas atmosphere of a *first pressure* in the processing vessel; and
- (3) imparting the affinity for the polar liquid (claim 26) or inorganic film (claim 30) to the organic film by irradiating the organic film with the electron beams with the *second voltage* applied to the electron-beam irradiation device, in the rare gas

atmosphere of a *second pressure* higher than the first pressure in the processing vessel.

In noting that Ross does not teach the pressure and voltage changes recited in claims 14, 16-18 and 22, the Office Action refers to the pressure and voltage parameters in Applicants' claims as result effective variables (see page 3). Applicants submit that the pressure and voltage parameters recited in new claims 26 and 30 are not result effective variables. Reference is made, e.g., to Example 9 and Control Example 2 set forth in the instant specification at pages 21-22.

The method carried out in Example 9 included an EB curing process divided into a first half stage and a second half stage. Both the pressure of the Ar atmosphere and the voltage applied to the electron-beam tubes were changed simultaneously in the EB curing process. The pressure of the Ar atmosphere was 10 torr, the voltage was 25 kV and the working current was 100  $\mu$ A for the first half stage. The first half stage was continued for 2 min to cure the SOD film. For the second half stage, the pressure of the Ar atmosphere was 40 torr, the voltage was 23 kV and the working current was 100 $\mu$ A. The second half stage was continued for 6 min to make the SOD film hydrophilic. The resulting SOD film had a k-value of 2.3, a contact angle of 10°, high wettability, and an excellent adhesive property.

The method carried out in Control Example 2 included only the first half stage of the EB curing process followed in Example 9. The SOD film formed in Control Example 2 had the same k-value of 2.3 as the SOD film formed in Example 9. However, the SOD film of Control Example 2 had a contact angle of 60°, indicating that the SOD film of Control Example 2 was inferior in wettability and adhesive properties as compared to the SOD film formed in Example 9.

Applicants respectfully submit that the results of Example 9 and Control Example 2 show that the changes in pressure and voltage occurring in the modifying step are important to the properties (particularly, the wettability and adhesive properties) of the final SOD film.

Thus, for at least this reason, Applicants submit that the use of first and second pressures and first and second voltages as recited in claims 26 and 30 are not result effective variables.

Accordingly, Applicants submit that new claims 26 and 30, as well as claims 27 and 28 (which depend upon claim 26) and new claims 31 and 32 (which depend upon claim 30) are patentable over the references cited in the Office Action.

**V. Conclusion**

In view of the amendments and remarks herein, Applicants respectfully request that the rejections set forth in the Office Action be withdrawn and that claims 1, 2, 8, 13, 14, 20, 21 and 25-32 be allowed.

If any additional fees are due in connection with the filing of this paper, such as fees under 37 C.F.R. §§1.16 or 1.17, please charge the fees to Deposit Account 02-4300; Order No. 033082M185.

Respectfully submitted,

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Enclosures: (1) Petition for Extension of Time (Three Months)

(2) Fee Transmittal Form

(3) Check for the Sum of \$1220